110 South Downey Avenue, Indianapolis, Indiana 46219-6406
Telephone 317-630-9060, Facsimile 317-630-9065
www.MundellAssociates.com

March 28, 2011

Ms. Erin Brittain
Project Manager
Voluntary Remediation Program
Office of Land Quality
100 North Senate Avenue
Indianapolis, Indiana 46204

Re: **Revised Work Plan for Third Round of CAP 18 ME™ Injections**
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana 46222
IDEM Incident # 0000198
IDEM VRP # 6061202
MUNDELL Project No. M01046

Dear Ms. Brittain:

This *Revised Work Plan for the Third Round of CAP18 ME™ Injections* is being submitted to the Indiana Department of Environmental Management (IDEM) by MUNDELL & ASSOCIATES, INC. (MUNDELL), on behalf of AIMCO, to describe upcoming remediation activities at the Site planned for April 2011. The following sections provide detailed discussions regarding the design of this third and final CAP 18 ME™ injection at the Site. Previous CAP 18 ME™ injections were completed at the Site in August 2007 and February 2009. ***Source Areas A*** and ***C*** are included in this Work Plan. No additional injection activities are planned for ***Source Area B*** at this time.

The trends of tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride in the areas of the chemical ***Source Areas*** (***A, B*** and ***C***) at the Site have indicated that dechlorination of the chemicals is still occurring (refer to the *Quarterly Monitoring Progress Report – 4th Quarter 2010* dated February 16, 2011, for specific data summaries and figures). Based on a review of the analytical data, it is apparent that complete dechlorination of all of the source PCE is not fully occurring in ***Source Areas A*** and ***C***, as shown in the concentration trends observed in monitoring wells MMW-P-02 and MMW-P-03S (***Source Area A***) and MMW-1S, MMW-9S and MMW-10S (***Source Area C***). As such,

MUNDELL believes that additional enhanced in-situ biodegradation efforts and the injection of additional CAP 18 ME™ product are required.

SENTINEL MONITORING WELL INSTALLATION

The Annual Michigan Plaza Site Status Update meeting was held at IDEM on March 23, 2011. Ms. Erin Brittain, Ms. Sarah Finley-Johanson and Mr. Bill Holland of IDEM, Ms. Sarah Webb and Mr. John Mundell of MUNDELL, and Mr. Peter Cappel of AIMCO were in attendance.

At the request of IDEM, MUNDELL will install one nested pair of monitoring wells south of the Plaza property to monitor remedial progress and indicator compound generation due to the proposed third CAP 18 ME™ injection in ***Source Area A***. The proposed well locations are shown on **Figure 1**. Prior to well installation, a soil boring will be advanced approximately 15 ft into the local till. MUNDELL anticipates the boring will extend to a depth of approximately 50 ft based on previously completed soil investigations in the area. Following soil description and screening at the soil boring location, one shallow and one deep monitoring well will be installed.

The deep monitoring well, **P-MMW-P-11D**, will be installed at the base of the aquifer unit. The 10 foot screened interval will extend to the aquifer/till interface. This location will monitor conditions in the deep aquifer interval. The shallow monitoring well, **P-MMW-P-11S**, will be installed adjacent to **P-MMW-P-11D** and utilize a 10 foot screen located within the appropriate depth interval to monitor the upper saturated zone of the aquifer for remedial response and daughter product generation. Previous shallow monitoring well installations in the vicinity have ranged in depth from approximately 28 ft to 30 ft. MUNDELL expects this installation to occur at a similar depth range.

Both permanent monitoring wells will be constructed of 2-inch diameter, flush joint, threaded Schedule 40 PVC materials. The monitoring wells will consist of 0.010-inch machine-slotted PVC screens, and the shallow monitoring well (**P-MMW-P-11S**) will be set at or within 2 to 4 feet above the groundwater surface. A sand filter pack, consisting of No. 5 sand, will be installed around the bottom of each screen to a height approximately 2 to 3 feet above the top of the screen. Ten foot PVC screens will be installed in the construction of monitoring well **P-MMW-P-11S** and **P-MMW-P-11D**. The monitoring wells will be backfilled with bentonite to 1 foot bgs. Flush-mounted, bolt-down steel manhole covers set in place with concrete pads will provide protection and stability to the wells. Watertight well caps will be fitted to each monitoring well to prevent the infiltration of surface water.

All soil cuttings generated during the drilling of the permanent monitoring wells and groundwater pumped out of the wells during well development will be placed in 55-gallon drums located at the Site for later disposal. In accordance with IDEM guidelines, the contents in each drum will be identified with a label describing them as non-hazardous materials.

These downgradient monitoring wells will be incorporated in the quarterly monitoring network starting the second quarter 2011, and the data will be presented in future reports.

CAP 18 ME™ BIOREMEDIATION DESIGN AND IMPLEMENTATION

CAP 18 ME™ Design

The amount and distribution of CAP 18 ME™ needed for each ***Source Area*** was designed taking several factors into account as well as the practical experience of the manufacturers of CAP 18 ME™, the Carus Corporation (Carus). The amount of CAP 18 ME™ to inject into the chemical ***Source Areas*** was calculated using the *CAP 18™ and CAP 18 ME™ Anaerobic Bioremediation Products Design Software* provided by Carus. This software takes into account the treatment area volume (based on plume size) and the soil characteristics (type, bulk density, fraction of organic carbon, total and effective porosity, hydraulic gradient and conductivity). The spreadsheet then calculates the dissolved and sorbed contaminant demand, as well as the background demand from geochemical parameters (i.e., the site levels of dissolved oxygen, nitrate, manganese, iron, sulfate and hardness). These parameters then factor into the stoichiometric demand for hydrogen, and the corresponding amount of CAP 18 ME™ needed for a particular treatment area. Microbial degradation and design contingency factors of safety are considered as well in the calculations. For this site, a factor of safety of seven was selected to allow for degradation and design uncertainties. Spreadsheet assumptions for the calculation of demand for CAP 18 ME™ for each ***Source Area*** are shown in **Table 1**. Computations estimated that approximately 2,100 lbs and 7,300 lbs of CAP 18 ME™ were needed for ***Source Areas A*** and ***C***, respectively, based on the cumulative indicator compound concentrations and geochemistry parameters obtained from January 2010 to January 2011.

Several iterations of CAP 18 ME™ injection distribution were evaluated using the *Bioremediation Products Design Software* and considering Site physical features. The first consideration was to determine what type of application would best fit the remaining plume's size and distribution in each ***Source Area*** given the geology, geochemistry and indicator compounds. The saturated zone within each ***Source Area*** has a poorly-graded, medium sand (SP) underlain by a well-graded, gravelly sand (SW). MUNDELL's experience with CAP 18 ME™ in sands at the Michigan Plaza Site confirms that fatty acids that get broken down through beta-oxidation can travel distances as great as 75 ft to 100 ft from the place of injection, thereby allowing "treatment" to continue downgradient as the fatty acids migrate and continue to lend hydrogen atoms for reductive dechlorination. Given this geologic advantage and the plumes being situated as they are in relation to Michigan Street and the Plaza building, it was determined that a 'treatment curtain' design distribution would be effective.

The injection spacing for the selected design is largely determined by the aquifer's ability to receive the product. An injection spacing of 10 ft to 15 ft on centers is considered very effective for the sands encountered at the Site. Curtain 'rows' stacked three deep are planned for ***Source Area C***, while a single-row curtain design will be implemented in ***Source Area A***. Curtain areas are generally oriented perpendicular to either the plume or parallel with building

walls that control injection accessibility. Additional injection locations are aligned along sewer location where impacts were previously noted in the vicinity of ***Source Areas A*** and ***C***. All planned injection locations are presented on **Figure 1**. This configuration was designed to provide the most thorough coverage per ***Source Area***. After the number of points was established per ***Source Area***, the total oil demand for each ***Source Area*** was divided by the number of points.

Based on previous CAP 18 ME™ injection events at the Site performed in August 2007 and February 2009, several design factors have been implemented. This design accounted for injecting the CAP 18 ME™ conservatively throughout a 12 foot and 20 foot thickness in the upper saturated zone at each injection point in ***Source Areas A*** and ***C***, respectively. These injection thicknesses allow for introduction of the product throughout the sand and gravel aquifer down into the top of the underlying silty clay glacial till, which acts as a barrier to further vertical groundwater movement.

Introduction of the CAP 18 ME™ into the aquifer at 3-foot depth intervals has proven to be the most effective injection strategy during the previous two injection events. In addition, injection of twice as much product into the upper 10 ft of the saturated zone as compared to greater depths places the product in the most impacted zone of the aquifer that is the result of previous releases from the former Accent cleaners.

Health and Safety

MUNDELL will prepare a Health and Safety Plan to ensure that activities for remediation will be conducted with industry standard safety measures, and that the surrounding public would not be threatened by any of the activities the occurred.

MUNDELL will contact Indiana Plant Protection Service (IUPPS) for utility locates in the specific areas being drilled. As a supplement to this utility locate, MUNDELL will also utilize its own geophysics department to provide more in depth locates of utilities and obstructions. Locations will be adjusted based upon the results of these utility investigations as needed.

CAP 18 ME™ Injection Application

CAP 18 ME™ injection remediation activities are anticipated to begin in April 2011. CAP 18 ME™ will be injected into each injection point using the following protocol:

1) At each injection point, the geoprobe will direct push the drill rods down to the bottom depth, as determined by the depth of the lower clay till layer.
2) The total poundage of CAP 18 ME™ loading designed per boring and a conversion of 7.7 pounds per gallon will be used to estimate the amount of gallons required. From this amount, the estimated amount of 3-foot lifts will be calculated, with the bottom lift being just into the clay till, and the top lift being anywhere from 1 to 3 feet above the observed water table (to account for seasonal fluctuations).

3) Calculated volumes of CAP 18 ME™ will be pumped from the 55-gallon drums using a geoprobe grout system, through tubing sealed and connected to the tooling rods down into the bottom of the drill rods, where it is slowly injected under pressure into the formation at the 3-foot lift intervals and loading requirements established above. At completion, each boring will be filled with granular bentonite and capped with either topsoil if in grassy areas, or asphalt patch in the parking areas.
4) greater depths allow for product placement in the most impacted zone of the aquifer.

Table 2 is provided which shows the summary of planned CAP 18 ME™ injection quantities for each injection point, and each ***Source Area***. Approximately 2,100 lbs and 7,300 lbs of CAP 18 ME™ are the expected injection masses for ***Source Areas A*** and ***C***, respectively.

We appreciate the opportunity to update IDEM on the upcoming remedial activities planned at the Site. If you have any questions, please do not hesitate to contact us at (317) 630-9060 or via email (jmundell@MundellAssociates.com; swebb@MundellAssociates.com).

Sincerely,

MUNDELL & ASSOCIATES, INC.

Sarah E. Webb, L.P.G.
Project Hydrogeologist

John A. Mundell, P.E., L.P.G.
President/Senior Environmental Consultant

Attachments: Tables
Figures

cc: Mr. Peter Cappel, AIMCO

TABLES

FIGURES

TABLES

TABLE 1

CAP 18™ and CAP 18 ME™ Anaerobic Bioremediation Products Design Software

Input Parameters and Estimation Methodology

Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

SOURCE AREA A

Treatment Area Volume		ESTIMATION METHOD
Curtain Length	40 feet	Based upon remaining chlorinated solvent impacts as indicated by Quarterly monitoring activities.
Thickness of Treatment Zone	12 feet	Saturated interval thickness in Source Area A
Well Spacing	10 feet	An injection spacing of 10 - 15 ft on centers is considered very effective for sandy saturated units, as encountered at the Site during previous soil investigations.
Treatment Area Characteristics		
Nominal Soil Type	SAND	Based upon field conditions observed during previous soil investigations.
Total Porosity	0.38	Default Values
Effective Porosity	0.29	
Hydraulic Conductivity	28.5 ft/d	
Hydraulic Gradient	0.003975 ft/ft	Calculated using the average hydraulic gradient from Quarters 1-4, 2010. The hydraulic gradient was calculated for each Quarter, then averaged across the four Quarters.
CAP-18 Lifespan	2 years	Based upon the estimated CAP 18 ME™ lifetimes observed following the 2007 and 2009 injection events.
Dissolved Contaminant Demand		
PCE	0.0133 mg/L	Averaged MMW-P-02 groundwater concentrations from Quarters 1-4 ,2010, and Quarter 1, 2011.
TCE	0.00536 mg/L	
DCE	0.0659 mg/L	Averaged MMW-1S groundwater concentrations from Quarters 1-4 ,2010, and Quarter 1, 2011.
VC	0.173 mg/L	
Background Demand		
Oxygen	0.872 mg/L	Averaged low flow sampling parameters as measured during Quarters 1-4 ,2010, and Quarter 1, 2011. (Wells included: MMW-P-05, MMW-P-06, MMW-P-04, MMW-P-03S, MMW-P-03D, MMW-P-02 and MMW-C-02) (Wells included: MMW-1S, MMW-8S, MMW-9S, MMW-10S, MMW-11S and MMW-12S)
Nitrate	0.14 mg/L	Averaged groundwater concentrations collected Quarter 1, 2011. (Wells included: MMW-C-02)
Manganese	2.0 mg/L	Default Value
Iron	5.25 mg/L	Averaged groundwater concentrations from Quarter 2, 2008. (Wells included: MMW-P-05, MMW-P-06, MMW-P-04, MMW-P-03S, MMW-P-03D and MMW-P-02)
Sulfate	40.3 mg/L	Averaged groundwater concentrations from Quarters 1-4 ,2010, and Quarter 1, 2011. (Wells included: MMW-P-06, MMW-P-03S, MMW-P-03D and MMW-C-02)
Hardness	496.8 mg/L	Averaged groundwater concentrations from Quarters 1-4 ,2010. (Wells included: MMW-P-03S)

TABLE 1

CAP 18™ and CAP 18 ME™ Anaerobic Bioremediation Products Design Software
Input Parameters and Estimation Methodology

Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

SOURCE AREA C

Treatment Area Volume		ESTIMATION METHOD
Curtain Length	48 feet	Based upon remaining chlorinated solvent impacts as indicated by Quarterly monitoring activities.
Thickness of Treatment Zone	20 feet	Saturated interval thickness in Source Area C
Well Spacing	12 feet	An injection spacing of 10 - 15 ft on centers is considered very effective for sandy saturated units, as encountered at the Site during previous soil investigations.
Treatment Area Characteristics		
Nominal Soil Type	SAND	Based upon field conditions observed during previous soil investigations.
Total Porosity	0.38	Default Values
Effective Porosity	0.29	
Hydraulic Conductivity	28.5 ft/d	
Hydraulic Gradient	0.003975 ft/ft	Calculated using the average hydraulic gradient from Quarters 1-4, 2010. The hydraulic gradient was calculated for each Quarter, then averaged across the four Quarters.
CAP-18 Lifespan	2 years	Based upon the estimated CAP 18 ME™ lifetimes observed following the 2007 and 2009 injection events.
Dissolved Contaminant Demand		
PCE	0.2042 mg/L	Averaged MMW-1S groundwater concentrations from Quarters 1-4 ,2010, and Quarter 1, 2011.
TCE	0.0365 mg/L	
DCE	0.0523 mg/L	
VC	0.0199 mg/L	
Background Demand		
Oxygen	2.27 mg/L	Averaged low flow sampling parameters as measured during Quarters 1-4 ,2010, and Quarter 1, 2011. (Wells included: MMW-1S, MMW-8S, MMW-9S, MMW-10S, MMW-11S and MMW-12S)
Nitrate	2.66 mg/L	Averaged groundwater concentrations collected Quarter 1, 2011. (Wells included: MMW-9S and MMW-11S)
Manganese	2.0 mg/L	Default Value
Iron	3.5 mg/L	Averaged groundwater concentrations from Quarter 2, 2008. (Wells included: MMW-9S and MMW-10S)
Sulfate	108 mg/L	Averaged groundwater concentrations from Quarters 1-4 ,2010, and Quarter 1, 2011. (Wells included: MMW-9S, MMW-P-03S and MMW-P-08)
Hardness	634.1 mg/L	

TABLE 2

Proposed CAP 18 ME™ Injection Locations Including Anticipated Injection Amounts

April 2011

Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

SOURCE AREA A

Injection Point Identification	Planned Injection Mass (lbs)	Planned Injection Volume (gallons)
1	365	47.4
2	365	47.4
3	365	47.4
4	365	47.4
5	365	47.4
6	365	47.4
7	365	47.4
8	365	47.4
9	365	47.4
10	365	47.4
11	365	47.4
12	365	47.4
13	365	47.4
14	365	47.4
15	365	47.4
16	365	47.4
17	365	47.4
18	365	47.4
19	365	47.4
20	365	47.4
SOURCE AREA A: TOTAL INJECTION AMOUNTS	7,300	948.1

SOURCE AREA C

Injection Point Identification	Planned Injection Mass (lbs)	Planned Injection Volume (gallons)
21	350	45.5
22	350	45.5
23	350	45.5
24	350	45.5
25	350	45.5
26	350	45.5
SOURCE AREA C: TOTAL INJECTION AMOUNTS	2,100	272.7
SITE-WIDE Injection Totals	**9,400**	**1,221**

FIGURES

MMW-13D
MMW-11S
MMW-11D
BLDG 6
601-611
BLDG 10
1001-1011
MMW-14D
MMW-12S
BLDG 2
201-211
1 2 3 4 5
6 7 8 9 10
11 12 13 14 15
16
17
BLDG 1
101-111
18 19 20
MMW-1S
MMW-10S
MMW-9S
MMW-8S

SOURCE AREA C:
CAP-18 loading,
estimated demand =
7,300 pounds via
20 injection points.

Michigan Street

MW168D
MW168S

MMW-P-07
MMW-P-08
MMW-P-10S
MMW-P-10D
MMW-P-01
MGW-5

Village
Pantry
(3801)

Former
Public
Library
(3805)

MMW-P-06
MMW-P-05

21
22
23
24 25 26

Former
Handicap
Workshop
(3815)

Former Office
Space(3817)

Zacatecas
(3819)

Michigan Plaza
Family Laundry
(3823)

MMW-P-02
MMW-P-04
MMW-C-01

P-MMW-P-11S
P-MMW-P-11D

SOURCE AREA A:
CAP-18 loading,
estimated demand =
2,100 pounds via
6 injection points.

MMW-P-03S
MMW-P-03D

MMW-C-02

Little Eagle Creek

MW171S
MW171D

Olin Avenue

NORTH

SCALE
0 80
feet

Keramida Monitoring Well Locations Referenced
from Keramida Environmental, Inc.
Project No. 2829
March 13, 2002

Cossell Road

MMW-P-09D
MMW-P-09S

LEGEND

MMW-C-01	Proposed Monitoring Wells (April 2011)
1	Proposed CAP-18 injection location (April 2011)
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01	MUNDELL Monitoring Wells (July/August 2008)
MMW-11S	MUNDELL Monitoring Wells (November/December 2008)
MGW-1	MUNDELL Soil Gas Well

Mundell
Consulting Professionals
for the Earth and the Environment

110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

Project Number: M01046
Drawing File: Inj_Pts_Rd3.skf
Date Prepared: 03/10/2011
Scale: 1"=80'

Proposed Monitoring Well Installation Locations and CAP 18 ME™ Injection Locations April 2011

Michigan Plaza
3801 - 3823 West Michigan Steet
Indianapolis, Indiana

FIGURE
1